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Feature Article - An Information and Communication Technology Satellite Account

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INTRODUCTION

This article discusses work to date by the ABS to develop frameworks, concepts and potential outputs for an Information and Communication Technology **(see footnote 1)** (ICT) satellite account. It includes the findings from a pilot study for Australia in respect of 1998-99 and discusses possible future developments in this work. The production of an ICT satellite account is an important contribution to empirical research as the rapid growth in production and use of ICT products is closely associated with the phenomenon known as the 'new economy'. It has been widely supposed that this growth was an important factor driving the strong, low-inflationary economic growth over the past decade in many countries.

The ABS already provides a variety of ICT-related information derived from its extensive suite of ICT surveys. These include the ICT Industry Survey, the Business Use of Technology Survey, the Household Use of Technology Survey, and the Government Use of Technology Survey. The ICT satellite account provides a framework in which these data can be brought together within one system for the whole economy. This not only has presentational advantages, but also forces consistency between the various components of the data sets and ensures, as far as possible, that all activities are included.

The construction of this pilot ICT satellite account provides added focus to the consideration of a number of questions related to scope, definitions, classifications, statistical methods and organisational issues as well as the identification of data gaps. It is acknowledged that there is scope for considerable improvement in the quality and range of outputs in the pilot ICT satellite account presented here. In particular, a number of data gaps had to be filled using assumptions or conjecture. **Accordingly, the estimates published in this article are to be treated as exploratory in nature**. The work to date is not expected to result in any revisions to the official national accounts.

The ABS was able to attempt the pilot ICT satellite account because of its extensive range of ICT-related data. Nevertheless, a number of data gaps must be filled if a more comprehensive and reliable ICT satellite account is to be constructed. The ABS is undertaking further investigations into the prospects of compiling a more complete and detailed ICT satellite account in respect of 2002-03.

THE CONCEPT OF A SATELLITE ACCOUNT

The national accounts are a comprehensive set of economic data which are exhaustive and

consistent within the boundaries of the economic activities they cover. However, there are certain limitations in what can be accounted for directly in the 'core' national accounting framework. Satellite accounts, as articulated in the **System of National Accounts 1993** (SNA93), allow for the provision of additional information pertaining to a particular activity or for the use of alternative concepts. The ICT satellite account is of the first form. It uses a national accounting framework to present a picture of ICT within the economy.

An ICT satellite account defines ICT products and identifies their supply and use, so that a comprehensive set of economic data relating to ICT activity can be compiled for the Australian economy. Among other things, this allows us to quantify the size of ICT production relative to other types of economic activity.

The scope of the ICT satellite account is determined by the definition of ICT goods and services. The Appendix describes those goods and services which are considered to be ICT in nature. While there is no formal ICT 'industry' as such, there is significant interest in industries in which businesses are predominately engaged in the production of ICT goods and services. The Appendix also lists those industries which are termed 'ICT characteristic industries' in this satellite account. Businesses in other industries may also produce ICT goods and services, particularly on own account. The ICT activities of these businesses are also reflected in the ICT satellite account.

The supply and use tables, which are the cornerstone of Australia's national accounts, provide the framework for the development of an ICT satellite account. The 'supply' table records the total supply of products within an economy. Total supply at purchasers' prices is made up of: domestic production at basic prices; imports; transport, retail and wholesale trade margins; and taxes less subsidies on products.

The 'use' table shows the use of goods and services in the economy. Total use is made up of: intermediate use by industry (products that are used by industries to feed into the production process); final consumption expenditures (products that are consumed by households and government and do not undergo any further transformation); gross fixed capital formation (products that are added to the capital stock because they are used repeatedly in production for more than one period); changes in inventories; and exports.

Supply and use tables provide a coherent view of the economy in which the total supply of goods and services equals their total use, and industry inputs sum to industry outputs. Hence, the use of all production can be accounted for and there are no discrepancies within the system. A feature of the supply and use system is that the supply and demand of each product are, as far as possible, independently calculated. A formal and systematic process of data confrontation then resolves discrepancies between supply and demand. In compiling the annual national accounts, this supply and use balancing process is undertaken for all products in the economy, so there is no statistical discrepancy, and the same result is derived for gross domestic product (GDP) whether it is calculated using the production, income or expenditure approach.

An ICT satellite account draws out and expands the information from the supply and use tables relating to ICT products. It also potentially brings to account a range of other information such as numbers of people employed on ICT-related activities.

The ABS has already produced and is working on satellite accounts in some other fields. Australian National Accounts: Tourism Satellite Account 2000-01 (cat.no.5249.0) and Australian National Accounts: Non-Profit Institutions Satellite Account, 1999-2000 (cat.no.5256.0) provide examples of satellite account methodology and outputs for those particular fields.

AN ICT SATELLITE ACCOUNT: POTENTIAL OUTPUTS

The 1998-99 pilot ICT satellite account presents a useful but limited range of data outputs. A full scale satellite account would have the capacity to generate a greater range of outputs. Outputs of potential interest that could be produced include:

- estimates of total ICT value added at purchasers' prices and share of GDP
- estimates of total ICT value added at basic prices
- estimates of the value added of major ICT related industries (such as ICT manufacturing and computer services) resulting from ICT activity
- estimates of domestic production of ICT products, by producing industry
- estimates of ICT products produced on own account for own use
- imports of ICT products
- the use of ICT products in the current period by each industry
- total household and government consumption of ICT by type of product
- capital expenditure on ICT products by industry
- exports of ICT products
- compensation of employees in ICT 'industries'
- gross operating surplus and gross mixed income in ICT 'industries'

The monetary aggregates described above are first dimension outputs. A feature of satellite accounts is that the first dimension outputs can be supplemented with non-monetary data, or second dimension outputs. Some second dimension aggregates of potential interest are:

- the number of ICT firms
- ICT firm size
- employment in ICT industries (and possibly some characteristics of employed persons)

A more detailed understanding of the sources of supply of ICT products and their use could assist government policy formation and assist research more generally. For example it would show: the level of domestic production of ICT products versus imports; which domestic industries are producing ICT products; the incidence of tax on ICT goods and services; and who is using ICT products.

A satellite account could facilitate investigation of where productivity gains arising from the production and use of ICT products are being achieved. In countries such as Australia, which do not have a large domestic ICT manufacturing industry, productivity analyses would focus on the use side. It is widely accepted that productivity improvements may arise from ICT use as well as ICT production. For example, the Productivity Commission **(see footnote 2)** has suggested that improvements in the productivity of the wholesale trade industry has been due, at least in part, to the increased use of ICT by that industry.

DATA SOURCES

Supply of ICT products

A substantial proportion of ICT-related supply side data can be sourced from the ABS ICT Industry Survey. This survey is generally conducted biennially, with the next survey planned in respect of 2002-03. The ICT Industry Survey targets specific industries where it is known that significant ICT production occurs. Since it targets a narrow range of industries where the production, import or sale of ICT products are primary activities (manufacturers of ICT goods; wholesalers of ICT goods; and providers of computer hardware/software-related services and telecommunications services), this survey is unlikely to capture ICT-related activity where such activity is a secondary activity of the business.

Currently, there are no data available for the supply of computer software produced on own account by businesses (other than those included in the ICT Industry Survey described above) or by governments. The estimates in the pilot account for 1998-99 were derived by extrapolating survey data available from the mid 1990s using a general indicator of ICT activity. This is a major weakness in the data.

The ABS compiles annual statistics on ICT goods imported and exported (data are obtained as an administrative by-product from the Australian Customs Service). Statistics on international trade in ICT services can be obtained from the ABS Survey of International Trade in Services.

Use of ICT products

The ABS conducts a general economy-wide annual Economic Activity Survey (EAS) which covers all non-general government units (excluding agricultural businesses). This is supplemented with information collected by the Australian Taxation Office (ATO). While the data items collected are necessarily general in nature, the following ICT-specific data items are presently captured for businesses: telecommunications expenses; software purchases expensed; software purchases capitalised; and capital expenditure on computer hardware and computer peripherals.

The current ABS strategy is to conduct the Business Use of Technology Survey on an annual basis. This survey focusses on details of technology use, but no longer captures detailed financial data. It is considered that the collection of detailed financial data in addition to technology use details results in unacceptable delays in producing the statistics.

The Government Use of Technology Survey relates to federal, state, territory and local general government organisations (but excludes educational organisations). The current ABS strategy is to conduct these surveys every second or third year, with the next survey scheduled to be conducted in respect of 2002-03. While the initial cycle of this survey contained reasonably extensive financial data, subsequent cycles collected a very limited range of financial data, instead focussing on such things as: the type and extent of government usage of various ICT products; measures of Internet usage; and various employee-related aspects of ICT use. The 2002-03 survey will see a return to the collection of more extensive financial data.

A detailed survey of retail activity is undertaken periodically in Australia, the most recent being in respect of 1998-99. This survey provides data on household expenditure on computers, computer peripherals and packaged software.

A detailed household-based survey of income and expenditure (HES) is also undertaken periodically within Australia, most recently in respect of 1998-99. It collects limited information on household expenditures on ICT products.

MAIN RESULTS FROM THE 1998-99 PILOT ICT SATELLITE ACCOUNT

The first table shows the various components of the supply of ICT products in Australia in 1998-99. In total, over $70 billion of ICT products, either locally produced or imported, entered the Australian economy in that year. The majority of the computer and communications hardware used in Australia were imported. These items also represented, in dollar terms, the most significant imports of ICT products. On the other hand, for each of the remaining ICT product categories, local production is the predominate or only component of supply. The item 'other computer services' includes installation and cabling services for computers, information storage and retrieval services, data processing services, computer consultancy services and other computer services. 'Margins' refers to the value of trade margins realised by retailers and wholesalers on the ICT goods they sell and the cost of transport of these goods.

SUPPLY OF ICT PRODUCTS, Australia-1998-99

	Domestic production $m	Imports $m	Margins $m	Net taxes on products $m	Total supply $m
Computer hardware	1,553	5,446	4,915	377	12,291
Communications hardware	2,069	4,095	5,174	331	11,669
Software-packaged & customised	3,913	906	1,703	42	6,564
Software-own account	4,930	-	-	-	4,930
Repair and maintenance	1,783	-	-	-	1,783
Other computer services	6,197	392	-	-	6,589
Phone and internet services	25,175	1,467	-	-	26,642
Total ICT goods and services	45,620	12,306	11,792	750	70,468

- nil or rounded to zero (including null cells)
Note: Data in this table are considered exploratory in nature and should not be considered as official estimates.

The next table shows the contribution of each ICT 'industry' to total gross value added at basic prices. The contribution of ICT to total gross value added at basic prices (for all industries) for Australia is estimated at around 4.9% in 1998-99. Businesses in the communication services industry contributed more to gross value added than businesses in all the other industries combined.

Value added to the economy, By industry-Australia-1998-99

	ICT output	Value added	Percentage of total industry gross value added
ICT characteristic industries(a)			
Manufacturing	3,021	983	0.2
Wholesale trade	8,070	1,534	0.3
Communication services	25,321	14,090	2.6
Other computer services	9,857	4,380	0.8
Other industries			
Other	11,143	5,695	1.1
Total	57,412	26,682	4.9

(a) Refer to appendix for the specific ANZSIC classes making up 'ICT characteristic industries'.
Note: Data in this table are considered exploratory in nature and should not be considered as official estimates.

The use of ICT goods and services within the economy is shown in the table below. 44% of ICT products were taken up as gross fixed capital formation by businesses and government, 36% were used by businesses as intermediate consumption, and 15% were consumed by households. ICT products make up a significant proportion of total gross fixed capital formation in Australia, contributing 22% of total gross fixed capital formation in 1998-99. The vast majority of household consumption of ICT products relates to phone carrier and internet provider services. Australia exports only a small proportion of its ICT production.

Use of ICT products, Australia-1998-99

	Intermediate use $m	Household final consumption $m	Gross fixed capital formation $m	Changes in inventories $m	Exports f.o.b. $m	Total $m

Computer hardware	-	1,281	9,924	314	772	12,291
Communications hardware	-	723	10,213	281	452	11,669
Software-packaged & customised	-	715	5,908	-377	318	6,564
Software-own account	-	-	4,930	-	-	4,930
Repair and maintenance	1,770	13	-	-	-	1,783
Other computer services	5,855	72	-	-	662	6,589
Phone and internet services	17,415	7,988	-	-	1,239	26,642
Total ICT goods and services	25,040	10,792	30,975	218	3,443	70,468

- nil or rounded to zero (including null cells)
Note: Data in this table are considered exploratory in nature and should not be considered as official estimates.

The last table shows the amount spent on ICT goods and services by those industries which had the biggest expenditure in 1998-99, ranked from highest to lowest. Expenditure is broken down into intermediate use (the amount spent on goods and services to be used within the current period) and gross fixed capital formation (expenditure that has been capitalised because the goods are expected to be used over a number of periods). The property and business services industry, which includes accounting, legal, computer and business services, scientific research, property operators and developers and real estate agents, had the biggest expenditure on ICT goods and services in 1998-99. This industry was followed by manufacturing; government administration and defence; finance and insurance; and communication services.

Use of ICT products, By industry-Australia-1998-99

	Intermediate use $m	Gross fixed capital formation $m	Total $m
Property & business services	4,723	5,551	10,274
Manufacturing	2,927	3,796	6,723
Government administration & defence	2,375	2,863	5,238
Finance & insurance	1,687	3,288	4,975
Communication services	2,290	2,498	4,788
Retail trade	2,632	1,278	3,910
Transport & storage	1,847	1,918	3,765
Wholesale trade	1,436	1,629	3,065
Accommodation, cafes & restaurants	1,254	1,082	2,336
Construction	812	939	1,751
All other industries	3,057	6,133	9,190
Total all indusries	25,040	30,975	56,015

Note: Data in this table are considered exploratory in nature and should not be considered as official estimates.

The pilot ICT satellite account has brought together a range of data and, through a formal process of data confrontation, has forced consistency between the various components of these data sets. Inevitably, the systematic confrontation of data within the supply and use framework has yielded some estimates that are different from those currently published. Since the data presented here are considered exploratory in nature, these differences are unlikely to prompt revisions to official data sets unless further verification work and/or work on a 2002-03 ICT satellite account justifies such revisions.

FUTURE PLANS

The ABS is undertaking investigations into the prospects of compiling a more complete ICT satellite account in respect of 2002-03. Investigations identifying the additional data requirements have been completed and a statistical strategy has been devised (see below). The ABS is currently testing key elements of the strategy to more formally assess its viability. If viable, the

ABS plans to complete an ICT satellite account for Australia in respect of 2002-03 by late 2004 or early 2005.

Much of the required ICT product detail on the supply side would continue to be obtained through existing collections, in particular the biennial ICT Industry Survey and from the international trade data system. The most significant data gaps on the supply side relate to ICT production of general government units and of businesses that have ICT-related secondary activity. This includes ICT output produced for own use, including development of software for in-house applications and production of various ICT goods for own use. The ABS would like to capture (through a variety of collection vehicles) separate details for ICT capitalised wages and salaries and other expenses relating to capital work done by own employees for own use.

A range of demand side data are currently collected by the ABS. For example, telecommunication services expenses, computer software expensed/capitalised and capital expenditure on computers and computer peripherals, are currently collected through various industry collections. The major data gaps relate to use of ICT products produced on own account (as described above), purchases of telecommunications equipment, and purchases of ICT products by institutions in the education industry.

The majority of the required additional demand data could be captured by adding questions to such existing collection vehicles as the EAS suite of collections and the ABS Government Use of Technology Survey (for the general government sector). The latter collection provides some possibilities of obtaining information for the education industry.

Information from existing ABS surveys of household expenditure and ICT use would also be utilised. The HES is expected to be an important source of information on household use of various ICT goods and services, and there are plans to include additional detail on these products in the 2003-04 HES. This information could be used to help break down high level expenditure estimates for 2002-03.

CONCLUSION

An ICT satellite account defines various ICT goods and services and identifies the supply and use of such products within the context of a balanced supply and use framework. A range of outputs can potentially be produced within the satellite account and, by using concepts, definitions and methods consistent with the 'core' national accounts, all of these outputs can be integrated with the national accounts. For example, a satellite account allows us to estimate the ICT contribution to gross value added at basic prices and GDP.

The ABS considers the body of data used in the construction of this pilot satellite account approaches the bare minimum required to generate a set of workable estimates. There are a number of data gaps which limit the quality of the output produced here. In particular, it is highly desirable to have independent estimates of both supply and demand in respect of each of the products. It is important that the scope of surveys extends to all significant areas of the economy. However, it is unlikely that we will ever achieve the ideal set of data required to support an ICT satellite account, and one of the challenges is to best deal with various data limitations.

If the 2002-03 ICT satellite account proceeds, it will benefit greatly from the lessons learnt in the pilot study. The practice of data confrontation necessarily requires a thorough examination of what each survey is capturing (data items, scope, etc.) and the quality of outputs. The rigorous assessment of available data points the way forward to the changes in scope and data items required to compile a more complete and detailed satellite account in the future.

FURTHER INFORMATION

For further information on the ICT satellite account-both the 1998-99 pilot and the possible 2002-03 study-please contact Tony Johnson, Director, National Accounts Research Section, ABS on telephone (02)62527297, or email, tony.johnson@abs.gov.au.

FEATURE ARTICLE ENDNOTES

1 Information and Communication Technology (ICT) is also often referred to as Information Technology & Telecommunications (IT&T). Trends in nomenclature seem to be favouring the term 'ICT' over 'IT&T' and so this article uses the former terminology. (Back to Feature Article)

2 Johnston, A., Porter, D., Cobbold, T. and Dolamore, R. (2000) **Productivity in Australia's Wholesale and Retail Trade**, Productivity Commission Staff Research Paper, AGPS, Canberra. (Back to Feature Article)

APPENDIX

ICT Products

The list below defines the scope of 'ICT products' as used in the 1998-99 pilot ICT satellite account. The data items collected through various survey vehicles (such as the suite of ICT surveys) are defined by the range of products to which we ascribe the term 'ICT'. It should be noted that the pilot ICT satellite account was only constructed in respect of the highest level grouping of ICT products. In a fully developed ICT satellite account much of this finer level detail could be presented on the supply side of the account but there is no real prospect of duplicating the same level of detail on the use side.

The definition of ICT goods and services continues to evolve rapidly. The ABS is currently working with a number of organisations throughout the world to establish consensus on such a definition.

Computer hardware, parts, components and consumables
Mainframe data processing machines
Other data processing machines-
Laptop, notebook and similar portable computers
PCs and similar desktop computers
Mid-range multi-user systems
Other computer hardware (excluding storage media)
Data processing machine parts and accessories (excluding carrying cases and covers)
Other input-output devices and peripherals (including scanners, disk drives, keyboards, monitors, etc)
Consumables (including removable storage media)
Other computer parts and accessories

Telecommunication hardware
Telephone and telegraph equipment (excluding parts, mobile, cellular and car phones) (including electrical line, electronic switchboards, modem equipment, telephones)-
Carrier telephone/telegraph equipment
Main exchange switching equipment
Electronic switchboards-(including processor or micro processor control)
Data modem equipment/multiplexors
Keyphones (excluding radio-telephony such as car phones)
Telephones, complete (excluding telephones operating by radio-telephony such as car phones)

Mobile, cellular and car phones
Other telephone and telegraph equipment (excluding parts) (for example teleprinters and telephone facsimile machines)
CB and other mobile radio transceiving equipment
Radio reception apparatus and other fixed premises radio transceiving equipment
Relays and relay sets for radio, telephone and telegraphic equipment
Satellite equipment
Other telecommunication equipment
Telecommunications cable and wire

Packaged software
Sales and licensing of packaged software
Computer games
Education and training packages
Communications packages
Other packaged business applications and systems
Recorded media
CD-ROM
Other pre-recorded computer tapes and disks

Customised software
Digital / multi media applications
Customised business applications and systems
Web-site design
Other Internet applications
Other customised computer services

Own account software
Software developed by a business's own employees for in-house applications

Provision of computer services
Other computer consultancy services
Installation, and cabling services
Data processing services
Information storage and retrieval services
Other computer services

Repair and Maintenance
Repair and maintenance of computer hardware
Repair and maintenance of computer software
Repair and maintenance of communications hardware

Telecommunication services
Provision of basic telephony services
Provision of mobile and paging services
Provision of data and text services
Provision of Internet services
Provision of other telecommunication services
Intercarrier charges (e.g. leased lines, other infrastructure and sales of capacity to other telecommunication operators)
Satellite services
Other

ICT Industry

The biennial ICT Industry Survey covers the main industries involved in the production and distribution of ICT goods and services in Australia. This industry view draws together a number of standard ANZSIC industries that generally match with the OECD definition of industries which specialise in ICT activity. In this satellite account they are referred to as ICT characteristic industries.

ICT characteristic industries

The list of industries below comprise the ICT characteristic industries. Those marked with an asterisk (*) contain a mixture of ICT specialists (i.e. businesses whose ICT income comprises 50% or more of their total business income) and other businesses. The remaining industries are considered to be comprised entirely of ICT specialists. ICT specialist businesses are considered to form the core of the ICT Industry in Australia.

Manufacturing

2430* Recorded media manufacturing and publishing
2841* Computer and business machine manufacturing
2842 Telecommunication, broadcasting & transceiving equipment
2849* Electronic equipment manufacturing
2852* Electric cable and wire manufacturing

Wholesale trade

4613 Computer wholesaling
4614* Business machine wholesaling nec
4615* Electrical and electronic equipment wholesaling nec

Telecommunication services

7120 Telecommunication services

Business services

7831 Data processing services
7832 Information storage and retrieval services
7833 Computer maintenance services
7834 Computer consultancy services

Other industries

This consists all other industry classes other than those listed as characteristic industries above. They include retailers who sell ICT products and the great majority of other industries that produce software for their own use 'in-house'.

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